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ABSTRACT

The family is an obvious group for whom problem solving effectiveness holds importance. Problem solving interaction refers to the manner in which the behavior of family members is organized to resolve situations in which there is an unachieved but attainable goal, and the means to overcoming the barriers to achieving the goal are not apparent, but are indeed feasible. Despite the considerable interest in problem solving, scholars continue to have difficulty capturing this ongoing family interaction with precise measurement tools. This difficulty in measuring and coding family interaction has resulted in an inability to gain clarity regarding the internal complexities of family problem solving. The purpose of this paper is to address this difficulty of precise measurement of family problem solving activities. Specifically, the procedures chosen and developed by Kieren and Hurlbut (1985) in a pilot study of non-random sequential problem solving interactions in three person family groups are used to illustrate four measurement dilemmas: (1) selecting a problem solving task; (2) developing a problem solving code; (3) making decisions about a coding recording scheme; and (4) assessing reliability. A three-page reference list concludes the document. (Author/NB)

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METHODOLOGICAL ISSUES IN THE MEASUREMENT OF NON-RANDOM FAMILY PROBLEM SOLVING INTERACTION

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ABSTRACT

The family is an obvious group for whom problem solving effectiveness holds importance. Despite the considerable interest in problem solving, scholars continue to have difficulty capturing this ongoing family interaction with precise measurement tools. This difficulty in measuring and coding family interaction has resulted in an inability to gain clarity regarding the internal complexities of family problem solving.

The purpose of this paper is to address this difficulty of precise measurement of family problem solving activities. Specifically, the procedures chosen and developed by Kieren and Hurlbut (1985) in a pilot study of non-random sequential problem solving interactions in three person family groups will be used to illustrate these measurement dilemmas: selecting a problem solving task, developing a problem solving code, making decisions about a coding recording scheme and assessing reliability.

Problem solving interaction refers to the manner in which the behavior of family members is organized to resolve situations in which there is an unachieved but attainable goal, and the means to overcoming the barriers to achieving the goal are not apparent but are indeed feasible. Family problem solving is an elusive activity to study. Even though it comprises much of daily family life, it is so dynamic that it is difficult to freeze the action long enough to measure all of its elements precisely. Measuring family problem solving is further complicated by several other factors. The activity may involve the entire family (problem solving by families) or only certain members (problem solving in families). The nature of the problem and its perceived severity or importance may also affect the interaction as does the setting, the resources of the family members and many other factors which have been detailed in Klein and Hill's (1979) theoretical model of family problem solving effectiveness.

While the primary criteria for a measurement tool is precision and validity, cost must also be considered given research funding limitations. Interaction research has involved smaller samples than other types of research because of the high costs involved in the collection and coding of the data. Thus the researcher is not only faced with selecting or developing measures which can handle the dynamic qualities of problem solving interaction but also those which are not too expensive in terms of money as well as time and effort.

THE RESEARCH PROBLEM

The interaction techniques discussed in the present paper were chosen to meet the needs of a pilot study of family problem solving for two groups of three person families - those with an adolescent with diabetes and those with an adolescent with no chronic illness (Kieren & Hurlbut, 1985). The purpose of the study was to describe the manner in which these two groups interacted to resolve common family problems which confront parents and adolescents at this stage of the life cycle. Of particular interest was detailing the patterns or steps (phases) which comprised their problem solving. The adolescent stage was selected because it has been described as a time when the adolescent has greater interest and involvement in the process. Families with diabetic adolescents were of primary concern because the researchers hypothesized that the nature of the family's problem solving interaction would have an impact on the level of management of the disease. The study used multimethod techniques to measure family problem solving. Only the relevant methodological details involved in resolving four dilemmas in selecting and developing reliable, valid and manageable measures of problem solving interaction for the study will be referred to in this paper. The dilemmas discussed are: selecting a problem solving task, developing a problem solving code, selecting a coding-recording scheme and assessing reliability.

Dilemma #1: Selecting a Problem Solving Task

In on-going family life there is an unlimited number of situations which may generate problem solving interaction. Each family, however, encounters different situations that are deemed to be problematic. The dilemma for the researcher is to select a particular task which will engage the group in the activity that is desired and which will be reasonably representative of the kind of interaction in which the family would engage if not being observed. In the present study, the researchers wanted the families to carry out the entire problem solving process from the initial steps to some resolution. They had also decided that the interaction would be observed in a laboratory setting rather than a home environment. The following criteria were established for evaluating the problem solving task: (1) **relevance**: the situation should be one which the family has encountered in some form; (2) **revealed difference between family members**: the situation should be one in which members have some degree of revealed differences in how it should be handled; (3) **family focus**: the situation should be one which has family rather than individual problem solving elements; (4) **adaptability**: the situations should be adaptable to families including adolescents with diabetics and those without; and (5) **manageability**: the situation should be one which can be resolved in a laboratory setting within a limited time frame.

A revealed difference technique modeled after Olson and Ryder's Inventory of Marital Conflicts (1970) was used to develop problem solving vignettes and these served as the primary problem

solving tasks in the research (Kieren, Hurlbut, Lehman & Gora, 1985). Typical problem solving situations were identified through a review of the general adolescent literature and the literature addressing family issues for teenagers who have diabetes. Salient situations were chosen and problem solving vignettes were written which addressed these issues. Separate parallel forms were written for male and female adolescents and for adolescents with and without diabetes. Pre-testing with families with adolescent members and professionals working with adolescent teenagers allowed the researchers to refine the vignettes. Nine vignettes on the following topics constituted the final form of the instrument: friends, going to parties, a family move, staying over at a friend's house, homework, invasion of privacy, housework, and mother returning to work. A sample vignette follows:

> Kelly, is involved in many activities. He is out at basketball with practices every night. Piano lessons also demand a lot of time, and the youth club meets several times a week. When he is at home, he just wants to relax. However, his parents would like him to help around the house by doing his part as a family member.

Each family member was asked to individually answer a series of forced choice questions about each vignette. For a copy of the questions see Kieren, Hurlbut, Gora, and Lehman (1986). Individual responses to the question "Has a situation like this ever occurred in your family?", provided information about the relevance of the situation for the family. A situation was deemed to be relevant if two or more family members reported it, or a

situation like it, had occurred in their family. Based on this information and individual revealed differences in responses, two of the nine vignettes were chosen as relevant problem situations for each family. One additional vignette, one on friends, was selected by the researchers for all families to discuss regardless of relevance or revealed differences.

The problem posed to the families was to discuss the problem vignette as a group and to arrive at a family rather than an individual solution of the problem. Families were given ten minutes to come to a solution. In order to vary several characteristics of the problem task and to test whether there are task effects in the patterns of problem solving, a second type of problem task was used. Families were asked to put together a difficult abstract puzzle. Again they were given ten minutes to work on this problem. All interactions were videotaped.

The problem solving task is more than a stimulus to generate problem solving interaction. Hoffman (1965) criticized problem solving researchers for their lack of attention to the characteristics of problem tasks. Out of this criticism there have been several attempts to categorize different problems by their task dimensions. The work by Tallman, Klein, Cohen, Ihinger, Marotz, Torsiello & Troost (1974), is an example of such an effort. Klein and Hill (1979) synthesized this attempt and several others into ten characteristics of problem tasks. These ten are: (1) Difficulty or complexity (amount of effort required); (2) Solution multiplicity (number of correct solutions); (3) Conjunctivity (degree of coordination or cooperation

required); (4) Pervasiveness (number of families affected by a problem); (5) Intellectual-manipulative requirements (ratio of mental to motor requirements); (6) External-internal source (imposed by outside or self imposed by family); (7) Requisite time (maximum time required to solve a problem); (8) Object barrier-interpersonal barrier (concerning material or member relationships); (9) Rule boundedness (degree to which rules or novel responses are required); (10) Control (degree to which family can control outcome). An analysis of most problem solving research indicates that there is little variability in the type of problems solved. Klein and Hill (1979) report that most problems have been moderate in difficulty, low on solution multiplicity, low on pervasiveness, externally imposed, low on requisite time, high on rule-boundedness and control and have involved object as opposed to relational barriers. It is not easy to vary problem tasks on these dimensions. We can only argue that we have achieved some minor variations on the tasks. The problem tasks used in the research varied on six of the 10 characteristics which Klein and Hill (1979) have suggested in the selection of problem solving tasks in problem solving research: difficulty, solution multiplicity, intellectual-manipulative requirements, requisite time, object barrier-interpersonal barrier, and rule boundedness.

It is evident from the present study that the problem task does have some effects. Phasing patterns were not problem specific. There were, however, task effects on effectiveness perceived. The abstract puzzle was very difficult and frustrating for families. This had a direct effect on their reported family

problem solving effectiveness (it was lower than for the other situations). It has been proposed that the characteristics of problems may have effects on problem solving interaction by generating certain kinds of interaction between members, and that the task may establish certain kinds of conditions which demand different types of problem solving behavior (Klein & Hill, 1979).

The work by Tallman and associates (1974) and Klein and Hill (1979) points to the importance of giving more attention to the selection and evaluation of the problem characteristics in any study of problem solving interaction. Careful control of the problem under investigation will allow one to begin to document the kinds of interaction which lead to effective problem solving and to begin to determine whether it is a realistic task to search for universal problem solving patterns which distinguish between more and less effective families.

Dilemma #2: Developing a Problem Solving Code

Once a problem solving behavior has been selected as a major variable in a piece of research, the task remains to decide on a technique to translate this behavior into meaningful and relevant quantitative units. Sackett, Ruppenthal and Gluck (1978) have suggested that there are four issues which one needs to consider to maximize the scientific utility of the observations: (1) How the questions of the study mesh with the specific measures to abstract the behaviors emitted by the participants; (2) How the questions mesh with the laboratory or field setting which has been chosen to make the observations; (3) Whether the measurement and

behavior sampling schemes yield information that can be generalized from one measurement time to another; and (4) Whether observers have achieved a sufficient degree of accuracy and consistency in measuring the behaviors under study. The choice of the observation tool relates specifically to the first of these overlapping concerns. There are a number of coding schemes which include problem solving assessments (e.g., Bales, 1950, Straus & Tallman, 1971, Raush, Barry, Hertel & Swain, 1974, Notarius & Markman, 1981). Because developing a coding scheme is not trivial, the practical question to ask is whether any of the existing methods are appropriate to answer the questions posed and fit the nature of the group under examination. The review of the existing schemes and prior use of The Bales Process Interaction Method (Kieren, 1983) did not present a scheme which tapped the sequential, stepwise process of problem solving in family groups. It was then decided to adapt the scheme developed to code conflict situations by Raush, et al. (1974) to fit the needs of the present study. The adapted coding scheme was developed from a particular theoretical view of the problem solving process. This is illustrated by the following problem solving loop (Kieren, Vaines, & Badir, 1985).

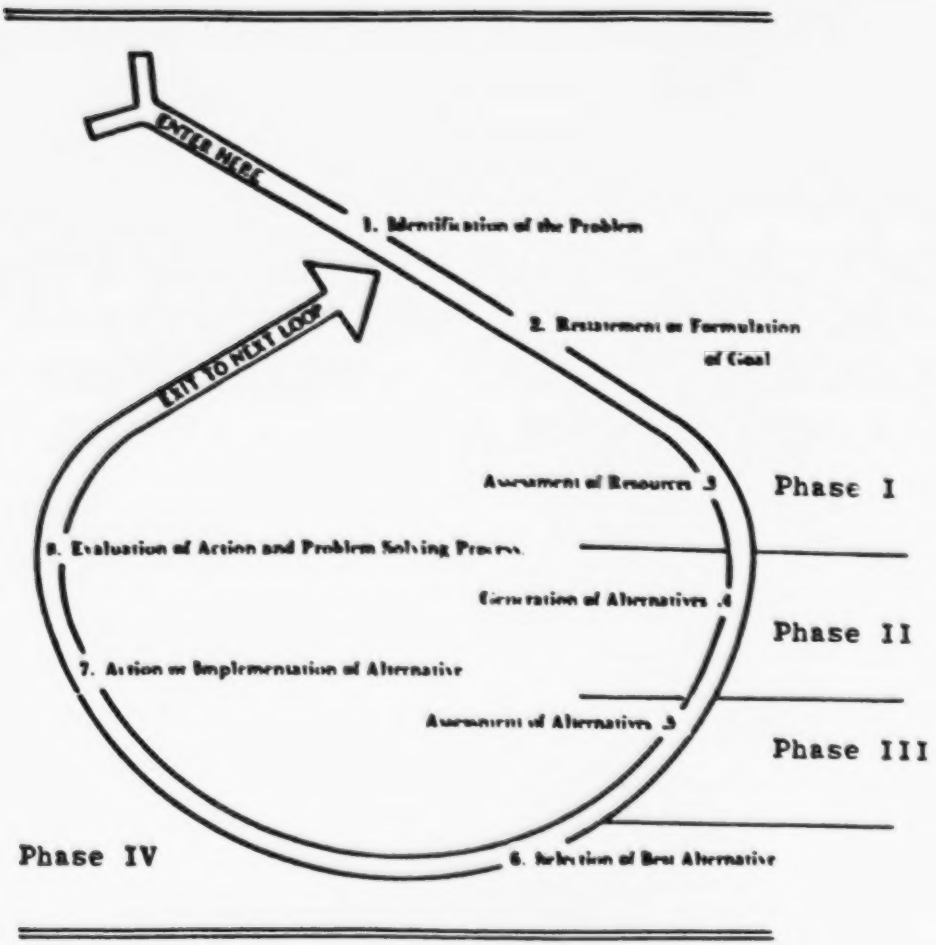
ENTER HERE
1. Identification of the Problem
2. Restatement or Formulation of Goal
Assessment of Resources .3
Phase I
8. Evaluation of Action and Problem Solving Process
Generation of Alternatives .4
Phase II
7. Action or Implementation of Alternative
Assessment of Alternatives .5
Phase III
EXIT TO NEXT LOOP
Phase IV
6. Selection of Best Alternative

FIGURE : The Problem Solving Loop

From: Kieren, D., Vaines, E., & Badir, D. (1985). The Home Economist As A Helping Professional. Winnipeg: Frye, p. 85.

The assumptions which provided the underpinnings of this conceptualization are:

1. Family problem solving is basically a logical and rational process (Brim, Glass, Lavin, & Goodman, 1962; Bales & Strodtbeck, 1951).

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2. The problem solving process can be organized into a series of interconnected steps or phases (Brim, et al., 1962; Bales & Strodtbeck, 2951, Kieren, Henton, & Marotz, 1975; Kieren, et al., 1985).
3. A family problem is any situation involving two or more of its members in which a potentially attainable goal is apparent and some barrier stands between the members achieving the goal.

The developer of any coding system needs to decide initially about the degree of specificity which is desired in analyzing the behavioral exchanges. When family groups are observed, the observation is complex. Sackett, et al. (1978) suggest that behavioral taxonomies may be divided into two different types: molecular and molar. Molecular systems break down the component behavior into pieces which are as finite as possible. This is an exhaustive system and is very time consuming to use. The second is the molar system. This one uses more general categories to analyze behavior. It is easier to code but may take more time to operationalize each of the categories. There is also more interpretation necessary to code behavior into a molar system. The present system falls into the molar category in that it focuses primarily on verbal interactions, however it is a complex code.

Ten verbal codes were originally adapted from the Rausch et al., (1974) scheme to represent behaviors in the eight steps of the problem solving process, (1. summarizes, clarifies, restates, 2. establishes a goal, 3. proposes an alternative, 4. gives new information but not an alternative, 5. seeks information, asks

question, 6. evaluates a solution, explores consequences, 7. talks about problem solving, metacommunication, 8. expresses agreement or approval, 9. expresses disagreement or disapproval, 10. makes decision). The codes were described in detail and assessed for face validity. The codes were described in detail and assessed for face validity. The coding system was then used extensively by two experienced coders in order to determine whether the codes were comprehensive and sufficiently discrete to distinguish between behaviors in the flow of family interaction. During this process a detailed training manual was prepared. After this developmental process, six codes were added to more fully detail the problem solving process (e.g., giving cognitive reasons for action, introducing compromise, appealing to fairness, pleading or coaxing, forcing agreement, commanding, positively evaluationg the potential for solving the problem, negatively evaluating the potential for solving the problem), and eight codes were added to handle more general interaction behavior comprising the problem solving process (e.g., clarifies, gives information, questions, answers, agrees, disagrees, sarcasm/humor and fragments). The complete twenty-six behavior code follows.

During analysis, the twenty six behavioral codes were combined into seven mutually exclusive problem solving summary codes. These were: fragments, identification of the problem, alternatives, evaluations, resolution mechanisms, decisions, and metaproblem solving. **Fragments** (00) were units with unclear or incomplete intended meaning; **identifications** (10, 02, 19, 20, 21, 22) stated the problem, established goals and such; **alternatives**

PROBLEM SOLVING PROCESS CODE

CODE NUMBERS

00 - Fragment

01 - Identifies problem

02 - Establishes a goal

03 - Proposes an alternative

04 - Explores consequences

05 - + Evaluates a specific alternative

06 - - Evaluates a specific alternative

07 - Cognitive reasons for alternative

08 - Compromise

09 - Fairness

10 - Coaxing

11 - Power

12 - Commanding

13 - Decision

14 - Evaluates solution and process

15 - + Evaluation of potential ability

16 - - Evaluation of potential ability

17 - Assesses Problem

18 - Metaproblem solving

19 - Clarifies, summarizes, restates

20 - Information

21 - Questions

22 - Answer

23 - Agreement

24 - Disagreement

25 - Sarcasm/Humor

(03) suggested how the problem might be solved; evaluations (04, 05, 14, 15, 16, 17, 23, 24) explored consequences, alternatives and assessed problem and agreement; resolutions (07, 08, 09, 10, 11, 12, 25) used statements such as cognitive reasons to get the family to agree upon a solution; decisions (13) resulted in a final choice. When family members talked about general problem solving and not the problem to be solved, the behavior was coded as metaproblem solving (18).

The code was useable and manageable but demanded a long period of training (average 45 hours). Coders were required to enter a four digit code for each coding unit: speaker, who was spoken to, and problem solving code number. Currently the code is being analyzed for possible streamlining for a subsequent study.

Dilemma #3: Deciding On A Coding Recording Scheme

One of the most costly parts of behavioral research is the coding of the data. Decisions related to whether observations will be coded on-site or from video or audio tape, whether transcription shall be employed or whether a mechanical coding device shall be used are crucial since all of these decisions have implications for the costs of the research. The criteria which guide the choice of a coding recording scheme are appropriateness, accuracy, and manageability given the nature of the interaction being observed and the funding available. The use of transcripts has been a preferred method of presenting the observational data for coding, even when videotaping is used to preserve the observational exchanges. This is because a transcript allows the

coder greater precision since the coding units are identified and can be re-reviewed. In addition, when two coders use transcripts, item-by-item calculations of intercoder reliability are possible. The use of transcripts however has disadvantages mainly because they are very costly to produce. In a previous study, 2 1/2 to 5 hours were required to produce "clean" transcripts for 10 minutes of videotaped family interaction, the variation depended upon the skill of the transcriber and the quality of the tape (Kieren, 1983).

The newer mechanical coding devices (e.g, the OS3 and the Data Myte) have the potential of being used without the transcription process, and also have time saving procedures in the analysis stage. It was decided to use the OS3 mechanical device (Holm, 1981) as the recording system for the present study. All interactions were videotaped as well so that the coder had the opportunity to re-review any interaction session.

The OS3 proved to be easy to learn to use, portable and allowed for convenient data storage of several sessions. It was not without problems however. The use of transcripts was not totally eliminated in that some transcripts were needed to train coders in identifying coding units as well as learning the problem solving code. In addition, coders felt more uneasy using the machine for coding compared with paper and pencil, even though it had editing possibilities. The major difficulties involved in using this device are that the support materials for analysis of data are not as yet well developed and therefore the data must be dumped from the OS3 to a larger computer system and that, even

once the data is on a mainframe computer, special programs need to be written to summarize the data into units for analysis. Also, assessment of inter-rater reliabilities are difficult. Since coders are not likely to be coding the same coding unit in the stream of interaction of three family members, item-by-item assessments of reliability are not useful. Time series assessments are also cumbersome with complicated coding systems. As the devices are used more these problems will undoubtedly be addressed in the literature and analysis procedures will be developed.

Dilemma #4: Assessing Reliability

The two main issues for any methodological technique are reliability and validity. In the case of observational techniques, reliability appears to be the more central of these two issues. No observational technique however well conceptualized will have scientific utility if it is not useable. Sackett, Ruppenthal and Gluck (1978) suggest that no scheme is useable if it does not minimize errors of ommission and errors of commission on the part of observers. Hartmann and Gardner (1981) defined the term observer reliability in terms of two different yet related paradigms: observer accuracy and interobserver agreement, reliability or consistency. Observer accuracy compares an observer's ratings with a set of criterion ratings. This type of reliability should typically exceed interobserver accuracy when both are assessed on the same data set with the same techniques. Interobserver accuracy involves the comparision of two presumably "flawed" sources of data.

One method of achieving 100% interobserver reliability is using film and tape recordings in a consensus coding procedure. This involves using two or more observers to view and review and score behavior until all agree that the scorable behavior has actually occurred and that the behavior fits a specified code category. Reliability is a non-issue in this type of coding. It is, however, an expensive procedure.

The subjective nature of coding and the number of evaluations which coders make prevent the elimination of all variations among coders. Extensive training procedures are usually implemented to decrease intercoder variation and increase reliability of coder evaluations. Assessment of inter-rater reliability not only has the utility of assessing the quality and therefore the accuracy of the data being collected but can provide an evaluation of the adequacy of coder training by identifying areas where change is needed in order to increase the precision of the measurement.

One crucial issue in the assessment of interobserver reliability is the determination of the behavioral unit upon which the analysis will be done. This is generally the coding unit, the unit of interaction upon which the coder is asked to apply the assignment of a particular code. When using coding methods which employ transcripts of the interaction, the coding unit is easily identified before the coders assign any codes. On the other hand, when techniques are employed without transcription, the problem is how to match each of the observer's recordings in order to compare them. This is further complicated when the data is not coded as categorical data. Use of event recorders such as the OS3 make this problem very evident.

Filsinger (1981) reported using the Efficient Percentage Agreement technique (Jensen, 1959) with a Data Myte recorder. The statistic reports the ratio of mutual observations to the sum of mutual observations and non-mutual observations. This technique appeared to be useful for Filsinger's coding system in which one coder focused on a single member of the couple and the other focused on the other; a very costly coding procedure when family groups are studied. Hartmann and Gardner (1981) suggested another method of solving the problem by dividing the stream of behavior into brief internals of 10 seconds durations and scoring 0 or 1 if the behavior occurred or not. The result of this approach is however to sacrifice information about the frequency and duration of the event. In addition, it does not appear to be useful when relatively complex coding schemes are being used for family groups. It is possible to imagine that a given coder over a 10 second stream of behavior may in fact code the behavior of the mother and miss the behavior of the adolescent child and thus not achieve congruence with the other observer. Selecting an appropriate method of assessing interobserver reliability when using a complex code, an event recorder and observing family groups remains a vexing problem.

In the present study we followed Hartmann and Gardner's (1981) suggestion that the detailed and molecular analysis of interobserver reliability should be used at the training phase or to revise the observer code or recording procedures. During training, coder reliability was assessed at several different levels. Observer accuracy was assessed first by tests on the

content and description of the code. Next, coding from transcripts of several sessions of the data was compared with a criterion code done by expert coders. Third, interrater reliability estimates were obtained from several sessions in which the coders had coded the interaction using both transcripts and videotaped interaction using a kappa statistic (Cohen, 1960). Retraining continued until interrater reliabilities reached .7 or above. Last, the coders were trained to code data without the benefit of transcripts. In order to increase their accuracy, reliability estimates were obtained on their ability to identify similar coding units from the stream of interaction in videotaped sessions. No further interrater reliability estimates were calculated during the coding phase. Coders were however asked to review the criteria at mid session to prevent the development of idiosyncratic interpretations of the code.

In an analysis of various coding-recording procedures used on a single session of problem solving interaction (Kieren & Munro, 1986), it was found that the data generated by use of the OS3 was remarkably similar to that produced using transcripts. It is suggested that this favorable comparison of data profiles gives further evidence that precision is not greatly sacrificed when transcripts are not used.

Reliability questions will continue to surface for researchers studying problem solving interaction. As funding sources for interactional research are limited, the use of transcripts cannot be justified and the use of techniques like event recorders will continue to be popular. Assessing interrater reliability with

these recorders is problematic. Reseachers must continue to search for techniques that will assure accurate data and at the same time not unrealistically increase the training time or the time required to conduct the reliability estimates.

SUMMARY

Family problem solving is a key family activity. The study of this important process is limited by difficulty in achieving precise and manageable measurement of this activity. Four specific dilemmas in measurement of family problem solving interaction were addressed in this paper. These four dilemmas illustrate the kind of measurement issues which researchers need to simultaneously consider when designing research in this important area.

Selecting a problem solving task is one of the most important aspects related to valid and reliable measurement. Selection of the task is guided by practical as well as scientific concerns. The problem solving task needs to be relevant to the family as a group and needs to be carefully controlled if the researcher hopes to document universal patterns that distinguish between effective and less effective family problem solving. Ten characteristics proferred by Klein and Hill (1979) were used as examples of the issues to consider when trying to control the task.

A second difficulty discussed was that of developing a problem solving taxonomy or coding scheme. The development of a taxonomy depends upon practical and theoretical considerations. The use of

the taxonomy has to be cost effective in that the coders can reliably use it and it isn't too time consuming or difficult to use.

The third difficulty, deciding on a coding recording scheme, is guided mainly by practical issues. Does the scheme give an appropriate, accurate and manageable account of the interactions being observed? Transcripts have been preferred; however, in the present study, coding from video without transcript was cost effective and reproduced data similar to that obtained from transcripts (Kieren & Munro, 1986). This was achieved by using the OS3 device.

The choice of a coding taxonomy and coding scheme is dependent on available reliability measures; similarly the choice of reliability measures is also dependent upon the particular coding taxonomy and coding scheme. In this paper many of the dilemmas relating to the choice of reliability measures were addressed.

Further systematic study of each of the four dilemmas discussed in this paper will enable scholars to achieve more precise measurement of family problem solving activities. This paper presents one attempt to identify and address these important methodological issues.

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